METHODS OF ACHIEVING MOTION IN STILL PICTURES FOR USE BY CLASSROOM TEACHERS

by

FREDRICK HANS JURGEMEYER
B. S., Kansas State University, 1965

A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

Approved by:

Harvey Littrell
Major Professor

LD
2668
R4
1967
J95
c.2

ACKNOWLEDGMENT

The writer wishes to express his appreciation to Dr. J. Harvey Littrell of the College of Education, Kansas State University, for the constructive criticism and advice given in the preparation of this report. The writer also wishes to thank Dr. Fred Teague, College of Education, Kansas State University, and Dr. Phillip H. Rueschhoff, Chairman, Department of Art Education, University of Kansas.

TABLE OF CONTENTS

	PAGE
INTRODUCTION	1
Statement of the Problem	1
Definition of Terms	2
Importance of the Study	2
MOTION THROUGH PHOTOGRAPHY	4
MOTION THROUGH GRAPHICS	5
MOTION IN SLIDES	7
POLARIZED LIGHT	8
History of Polarized Light	9
The Process	10
Polarizing filters	10
Achieving effects	14
Preparing the projectual for presentation	20
Motion Simulation	21
Teacher-made materials	21
Commercially-made materials	25
Polaroid Vectograph film	31
MOTION EMPLOYED IN THE CLASSROOM	36
SUMMARY	40
BIBLIOGRAPHY	43

LIST OF FIGURES

FIGURE		PAGE
1.	Plane Polarized Light	11
2.	Circularly Polarized Light	13
3.	The Transmission of Light through Parallel and Perpendicularly Aligned Polarizing Filters . .	15
4.	Effect of Cellophane on Light Refraction in a Polarized Projectual System	17
5.	Plan for a Polarized Light Test Box	22
6.	Cutting Method for Creating Flow	26
7.	Method of Simulating Vertical Linear Motion . . .	27
8.	Method of Simulating Horizontal Linear Motion . .	28
9.	Methods of Cutting and Application to Achieve Circular Motion	29
10.	The Construction of Vectograph Film	32
11.	Effect of Superimposition of Vectograph and Diazochrome Films	34

INTRODUCTION

The world of the student is one of constant motion. In order to make the learning environment consistent with the realism of the student's world, motion must also be employed in the production of teaching materials. The educational film is based on this premise and has proved itself to be a valuable teaching tool.

Money made available to schools through Federal aid to education and technological advances have drastically increased the use of visual presentation media by the classroom teacher. Most affected, has been the use of the new economical, lightweight overhead projectors. However, materials produced for use with the overhead projector have almost entirely been limited to the flat still picture. Presentations could many times be improved by adding motion. Research needs to be done to determine the best ways of using motion in still pictures to suit the local needs. Motion must be employed in the classroom more frequently if improvement is to take place.

Statement of the Problem

The purpose of this report was to research various methods of increasing effectiveness of still media by incorporating motion into the presentation. Special emphasis was placed on researching methods which could be easily employed by the classroom teacher.

Definition of Terms

Motion was defined for the purpose of this study as movement, both real and implied, taking place within the flat object used as a device to stimulate interest.

Still pictures, for the purpose of this study, were divided into two groups: (1) flat opaque pictures (photographic prints and drawings or paintings), and (2) transparent pictures (slides or filmstrips, either photographic or non-photographic).[1]

All further use of these terms within the report were limited to these definitions.

Importance of the Study

By incorporating motion into the still picture, there are several noteworthy advantages which may come about as a result of their use. Many of these advantages coincide with advantageous properties which could be listed for film use. The following advantages were adapted from a list for films by Brown.[2]

This type of media lends itself well to use with students whose reading skills are deficient. The student who has difficulty visualizing the operation of an internal

---

[1]James W. Brown, et al. A-V Instruction: Materials and Methods (New York: The McGraw-Hill Book Company, 1964), p. 437.

[2]Ibid., pp. 168-80.

combustion engine solely from a verbal description may be greatly helped by a presentation with moving parts that visually describes the process. Students who lack interest in the subject may be drawn to it by the more dramatic type of presentation.

Motion in still media may help to overcome physical limitations. Some phenomena are blocked from normal observation because they take place inside of something. In this way the inside of a complicated piece of machinery may be seen and the working together of the component parts while in motion may be observed.

In the study of certain concepts, such as in art and architecture, color may play an important role. The understanding of physics, chemistry, nature, historical costume design, and biology may be broadened by the use of color. Not only may color be added, it may be changed during the presentation by using polarized light discussed later in the study.

Enlargement of a small part of a larger unit or operation can be especially valuable. For example, how a tiny cog contributes to the movement in a wristwatch can be illustrated in this way.

Abstract ideas can at times be conveyed easier by abstract forms and representations in motion.

It is natural for the human eye to be attracted by movement. A car driving through a lot of parked cars will

be easily noticed. Movement in media in this way compels the attention of the student.

MOTION THROUGH PHOTOGRAPHY

Probably the easiest way for the teacher to involve motion in his presentations is through photography. There is a large scale use of photographic techniques in today's world. Magazines and other publications contain many photographs of quality that may be used by the teacher. The teacher has a relatively simple task to find enough photographs to cover the subject of a bulletin board. Where available, these bulletin boards can become a valuable teaching tool.

Some photographs may be chosen because they have inherent motion within them. For example, the picture of the cascading waterfall can be said to include inherent motion. A close-up picture will include more motion than a distant shot. A distant picture of the waterfall may show little action while a close-up will reveal the churning power of the water. A photograph with horizontal and vertical lines in it tends to remain static while oblique or diagonal lines denote action. Color can also play a part in the choice of photographs for use on a bulletin board. Pictures with the colors of gray, green, beige, and brown give a feeling of quietude. On the other hand, use of red, yellow, and blue

make the photograph more lively.[1]

Certain photographic techniques can also increase the feeling of motion in the picture. A dramatic effect is achieved when several exposures are superimposed over the top of each other. This technique gives the feeling of the subject matter moving towards the viewer. Motion may be included in the bulletin board by choosing pictures which involve action and are taken at a shutter speed which causes the moving object to become somewhat blurred. For example, a picture of a child running taken at 1/500 of a second will completely freeze the motion and possibly leave both feet off of the ground. However, reducing the shutter speed to 1/125 will give a picture that is blurred to indicate speed while the subject matter and background still remain distinguishable.[2]

MOTION THROUGH GRAPHICS

For centuries, artists have tried to achieve a feeling of motion in their drawings and paintings. As early as the 14th century, stories were told in paintings by combining many scenes or happenings into one painting. This can be evidenced in Hans Memling's "The Martyrdom of Christ" where

---

[1]Fritz Henle, "Camera...Action!" Popular Photography, 53:28, September, 1963.

[2]Ernest Wildi, "Must Dimension: Motion," Popular Photography, 54:110-113, June, 1964.

the last few days of Christ's life are all represented on the single canvas. Christ is pictured many times in the painting starting in the lower left-hand corner and running in the form of a "w" to the upper right where the crucifixion is seen.[1] Also, in a drawing "Tingle-tangle" by Edvard Munch in 1895, the different positions of the dancer's leg in the process of kicking may be seen.

The art movement of "Cubism" was based on striving for motion in the picture. Instead of showing a face on one plane, it would be drawn or painted so as to show several different "views" or planes simultaneously. For instance, both the side and the front of the face might be shown within the same painting.[2]

Today, in non-objective art, movement is frequently achieved by allowing the viewer's eye to visually draw in the missing pieces. For example, if the viewer looks at a row of dots, his eye will automatically connect these dots to form a line.[3]

---

[1]Laszlo Moholy-Nagy. Vision in Motion (Chicago: Paul Theobald and Company, 1947), p. 120.

[2]Ibid., p. 119.

[3]Line #5, a film produced by Henk-Newenhouse, Incorporated, Northbrook, Illinois, 1965.

MOTION IN SLIDES

An interesting process of incorporating motion into 2x2 slides has been developed by Dr. Phillip H. Rueschhoff and his students at the University of Kansas. The process is really quite simple; the heat of the projector is used as an energy source to create motion.

Two inch square slide mounts are prepared using two pieces of medium weight clear acetate. Sandwiched between the two pieces of acetate can be any number of materials. Minute pieces of crayon with a heavy wax content, candle wax, rubber cement, and shampoo were examples of materials found to give the most successful kind of movement.[1] Other stable materials consisting of such minute parts of nature as stamen and parts of leaves may also be used. When the slide is placed in the projector, the heat of the lamp causes the viscous elements to melt and motion takes place projected on the screen.

Another method of achieving motion has been developed which is similar in nature to the above stated process. Small pieces of Austrian tissue, colored cellophane, and lightweight colored acetate are placed between the sides of the mount. The mount is constructed so that the wind currents from the projector can hit and move the pieces. This process

---

[1] From a letter written by Dr. Phillip H. Rueschhoff, Chairman, Department of Art Education to the writer.

has been found to be somewhat less successful than the first method.

Both of the above methods were found to be extremely useful in the teaching of painting to junior and senior high school students. The processes have helped the students to develop "an aesthetic awareness which has carried over into quality painting which normally would be impossible without the previous experience."[1]

Some experimentation has taken place using the slide projector and polarized light. A discussion of this subject will take place in the next section.

POLARIZED LIGHT

In the opinion of this researcher, the most exciting and promising method of introducing motion into presentations is through the use of polarized light. In the following discussion, polarized light will be dealt with as it relates to overhead projection although it lends itself to use with other types of equipment. It is in this area that the most experimentation has taken place and consequently materials for local production by the classroom teacher are most easily secured.

---

[1] Ibid.

History of Polarized Light

As with many other scientific discoveries, polarized light was discovered before it was needed for a specific use. In 1812, Sir David Brewster discovered that clear stressed glass when examined in white polarized light showed colored patterns.[1] However, this discovery was not made use of until over a hundred years later because of the brittleness of the material which he was using. The development of plastic and the theory of photo-elasticity led to the use of polarized light by two English engineers, Felon and Coker. They used the method to solve engineering stress problems because it could be used to solve problems which could not be solved mathematically. Their first use was with clear plastic models.

During more recent times, the application of polarized light to teaching or overhead projection has come about. First developed in England, the process has been enlarged upon by several American visual production equipment firms, principally the Technifax Corporation of Holyoke, Massachusetts. Its future development lies in the hands of the users; public school teachers, college personnel, and members of industry.

---

[1] E. A. Taylor. A Manual of Visual Presentation in Education and Training (New York: Pergammon Press Limited, 1966), p. 227.

The Process

Polarizing filters. The process of polarized light is based on the thesis that light travels along straight paths and is propogated as a series of transverse vibrations lying in one or all of the planes containing the ray. When the transverse vibrations are confined to parallel planes, the light is said to be "plane polarized". (See Figure 1). Plane polarized light is usually obtained using Polaroid filters. These filters are constituted by a sheet of plastic in which is embedded a layer of uniformly oriented needle-shaped crystals of quinine iodosulphate.[1]

Quinine iodosulphate is used because it possesses the property of dichroism; it resolves light rays incident upon it into two components and absorbs one of them almost entirely. More recently, polarizing filters have been made by carefully aligning the molecular structure of the substance and contain no crystals. For example, the center of the filter may consist of polyvinyl alcohol, a tough clear plastic which is stretched in one direction so that the long tangled molecular construction becomes straightened into parallel lines. The filter is then sandwiched between two sheets of cellulose acetate butyrate, one of the toughest plastics known, for protection.[2]

---

[1] Ibid.

[2] Ibid.

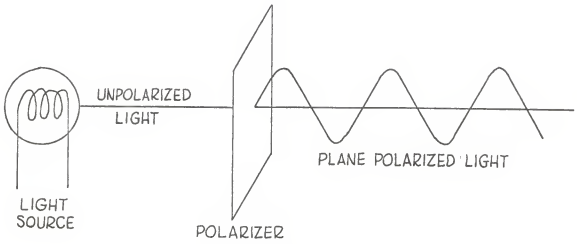

FIGURE 1

PLANE POLARIZED LIGHT (FROM TAYLOR, A MANUAL OF VISUAL PRESENTATION IN EDUCATION AND TRAINING)

Circularly polarized light (See Figure 2) may also be produced by creating a situation where two polarized light waves of the same amplitude and frequency are made to vibrate at right angles and a quarter of a wave length out of phase.. The path traced by the tip of the light vector will then take the form of a circular helix. This process is accomplished by the use of quarter wave plates made of birefringent material such as mica which has a thickness related to the wavelength of the light source. This system has not, unfortunately, been used in educational presentations except in the fields of engineering and science.

In the overhead projection system, two polarizing filters are required. The projectual is always located between the two filters in a parallel plane although this may be done in a number of ways. Both of these filters are essentially the same, in that the material through which the light is projected is identical.

The filter which is placed between the light source and the projectual is known as the "polarizer". This filter may be fastened to the back of the projectual or to the stage of the projector. Normally the latter process is used so that one filter is used for all the different projectuals in a group.

Between the projection lens and the projectual is located the second filter known as the "analyzer". The analyzer is a

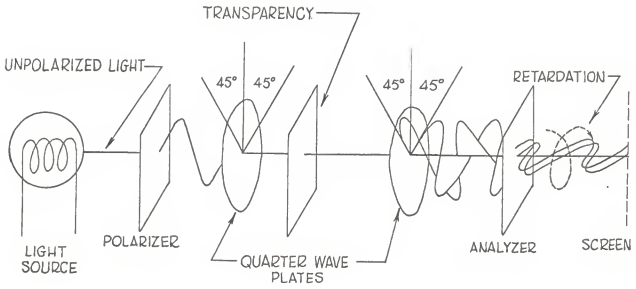

FIGURE 2

CIRCULARLY POLARIZED LIGHT (ADAPTED FROM TAYLOR, A MANUAL OF VISUAL PRESENTATION IN EDUCATION AND TRAINING)

sheet of polarizing filter which is circular in form and can easily be rotated. The analyzing filter occurs in three basic variations. One type is located directly beneath the projection head. This type is usually rotated by hand. Another type is mounted in front of the projection lens and easily attached or removed. It may be manually operated but is normally driven by a small motor. The "stage analyzer" is the third variance and is placed directly on top of the projectual. It is always manually rotated by means of a small crank. The advantages of this type of filter are that it is less expensive than the other two and can be used most efficiently when only a few polarized projectuals are to be used. Also, when the presentation is only partly made up of polarized projectuals, this type is useful.

Achieving effects. The process of polarizing projectuals is one of controlling the subtraction of variable wave lengths of light from the projection beam by varying the angle of the stress lines within the two filters. Light can readily be projected through either of the filters or when the lines of stress of the filters are aligned. However, if one filter is turned to an angle of 90 degrees to the other, practically no light can be transmitted to the screen.[1] (See Figure 3). Gradations will fall between the angles of

[1] "Polarized Projectuals" (Holyoke, Massachusetts: Technifax Corporation, 1961), p. 1.

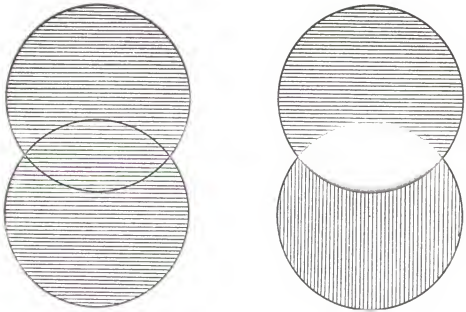

FIGURE 3

THE TRANSMISSION OF LIGHT THROUGH PARALLEL AND PERPENDICULARLY ALIGNED POLARIZING FILTERS (FROM POLARIZING THE PROJECTUAL, TECHNIFAX CORPORATION)

0 degrees and 90 degrees. In order to complete the interference necessary to provide polarization, a transparent stressed material such as cellophane is fastened to the projectual at various angles. Cellophane lends itself well to use because of the manufacturing process. Normally it is manufactured under sufficient tension and heat that tensional striations, or lines of stress, are created. By nature of the process, the lines are always parallel to the edges of the roll. Although they are difficult to see with the naked eye, they are sufficient enough to cause the necessary interference with the polarized light.[1]

When the cellophane is placed between the polarizing and analyzing filters and the stress lines of the cellophane are aligned (parallel) with the stress lines of the polarizer, the cellophane will not interfere with the polarized light. The cellophane under these conditions is invisible. However, as the cellophane is rotated 45 degrees, the light is bent or refracted out of polarization. This allows the light to penetrate the area which has been covered by the cellophane. (See Figure 4). The angle of refraction is different for each of the colors which, blended, compose white light. The angle of the stress lines of the cellophane in relation to the stress lines of the polarizer determines the color projected by the cellophane.

---

[1] Ibid., p. 2.

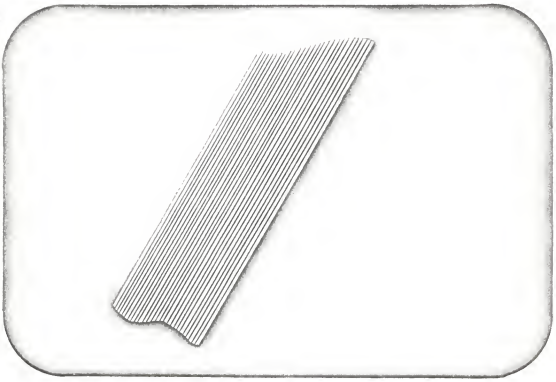

FIGURE 4

EFFECT OF CELLOPHANE ON LIGHT REFRACTION
IN A POLARIZED PROJECTUAL SYSTEM
(FROM POLARIZING THE PROJECTUAL,
TECHNIFAX CORPORATION)

In order to achieve polarization effects, the cellophane must be attached to the transparency at an angle relative to either the top or the bottom of the projectual. Generally an angle or 45 degrees is used where the desired effect is to take place. When an effect is wanted in two adjacent areas, an additional piece of cellophane is placed over the second area at an angle of 15 degrees. This angle of 15 degrees is also used when color is desired.

The angle of 15 degrees is used when producing color because this allows the rest of the projectual to be neutralized. This cannot be done when an angle of 45 degrees is used although color is still produced. Color variation is affected by refracting the light through both the polarizing filters and the cellophane. The three elements function together as a prism and break up the light into the color spectrum. Motion of the filters in relation to each other or the cellophane produces the startling changes in the color of light which reaches the screen. Usually this process is carried out by rotating the analyzing filter. If either of the filters is removed, no color will show in the areas covered by the cellophane.[1]

Color is always produced when two or more layers of cellophane are placed on top of each other at an angle of 45 degrees regardless of the position of the analyzer.

---

[1] Ibid., p. 3.

Because of this, it is better to use the angle of 15 degrees which allows the projection of color and neutral tones simultaneously. For example, using the angle of 15 degrees with three layers of cellophane, the projected color can be changed from neutral to light-blue, to medium-blue, to copper, and back to neutral...all through rotation of the analyzer.

Single layers of cellophane produce a basic color; two layers, a different color; three, a third color. It is possible to obtain more than 300 recognizable different hues by using varying numbers of layers of cellophane employing either the angles of 15 or 45 degrees. Normally, no more than five layers are used for classroom projection although seven is considered the maximum.[1]

For best results, negative backgrounds are used with polarized projectuals because they provide the greatest amount of contrast and brightness between the field and the polarized areas. Since the projection beam loses much of its intensity after passing through the filters and the projectual, the areas containing polarized effects must be basically transparent. This is most easily accomplished with the solid black background of the "negative" copy. Excess cellophane extending into the black field will not

---

[1] Ibid., p. 4.

show upon projection. This makes the negative copy easier to construct since less precise trimming is required.

Value contrast can be achieved by a method called "ghosting". This process allows the presenter to subdue, cancel out, or highlight certain areas. This is done by attaching a single layer of cellophane at an angle of 45 degrees. By rotating the analyzer, the field outside of the cellophane area may be subdued or the cellophane area itself may be subdued while light passes through the rest of the projectual. Also, the entire projectual may be neutralized with light passing through.

Preparing the projectual for presentation. The polarized projectual should always be prepared through experimentation in advance of a presentation. The projectual should be properly stationed on the stage of the projector and the analyzer rotated until the desired effects are achieved. By noting the index number or degree marking of the analyzer pointer, exact effects may be recorded on the frame of the projectual. In this way, the presenter may know exactly what is happening on the screen behind him without turning around during the presentation. For example, if the frame is marked 6-3-1, the six would indicate the first effect, the three the change from the first effect to the second effect, and the one is the final desired effect.

If the presenter uses a large number of polarized projectuals in his presentations, it may well be worth his time to build a polarized light test box. (See Figure 5). One may be built economically and easily by the most unexperienced teacher.

Motion Simulation

Teacher-made materials. Basic projectual motion is achieved by using the analyzer and a stage filter. An alternating on-and-off light transmission takes place as the analyzer is rotated. This blinking is the result of the parallel alignment and the cross alignment of the stress lines of the two filters. Some examples of the use of this simple effect are simulation of a blinking stop-light, a swinging pendulum, the on-and-off positions of an electrical switch, rain, or piston thrusts.[1] In order to make this type of projectual, cellophane is adhered at an angle of 45 degrees on the portion exhibiting the "on-effect". The "off-effect" is achieved without using a cellophane covering. It is important for the presenter to know that a polarizing stage filter must be placed between the projector and projectual when cellophane is used. The stage filter can be handmade by taping a piece of polarized film to a

[1] "Polarizing the Projectual," Audio-visual Instruction, 7:243, April, 1962.

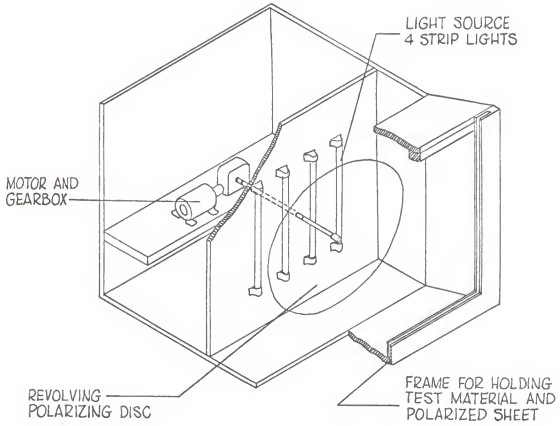

FIGURE 5

PLAN FOR A POLARIZED LIGHT TEST BOX (FROM TAYLOR, A MANUAL OF VISUAL PRESENTATION IN EDUCATION AND TRAINING)

projectual mount with the film covering the entire aperture of the mount.

Instead of using cellophane, pieces of polarized filter material may be used. However, when using this process, both elements of the action must be covered by a separate piece of filter material. The areas of stress must be perpendicular to each other in order to give the blinking effect. The exact perpendicular angle can be found by superimposing two pieces of filter material and rotating them in front of a light until they appear dark blue. When filter material is used in place of cellophane, no stage filter is required. Cellophane is not as effective in canceling projection-light as is filter material, but it is less expensive to use.[1]

Simple motion effects are most commonly created through the use of cellophane and polyethylene. Rubber cement, thinned to a fine consistency, is used to fasten the motion producing material in place. When thinning rubber cement, it is wise to use the same brand of cement and thinner. As in producing color effects, simple motion effects should be used with a dark negative background to facilitate projection and lessen the amount of trimming.

---

[1] "Polarized Projectuals" (Holyoke, Massachusetts: Technifax Corporation, 1961), p. 5.

There are several techniques that can be used to manipulate cellophane so that the desired effect is realized. Crumpled cellophane, placed on the stage filter, will give a vari-colored prismatic effect as the analyzer is rotated. If after being crumpled, if the cellophane is smoothed out and attached over large background areas, it will create a silvered textural effect of three dimensional depth. Shifting lines of color may be achieved by superimposing strips of cellophane at random. An interesting effect is executed by placing these strips behind reverse (clear) lettering. The simulated action of boiling water, chemical reactions, and combustion in a chamber can be accomplished by attaching small irregular bits of cellophane to the projectual. When polyethylene is stretched or mutilated and attached to a projectual, it gives vivid-colored swirling effects which may be used to represent mist or smoke. However, polyethylene should be used only for this effect because it is too soft and pliable to be used for contrast effects.[1]

It is also possible to animate transparencies to simulate linear and circular motion, to flow up, down and along pipes. Strips of cellophane are cut at varying angles to the plane of polarization and fastened to the projectual. Three inch wide cellulose tape is a good

[1] Ibid., pp. 5-6.

material to use because the adhesive on the back facilitates easy application. (See Figures 6-9). The speed of the linear or circular flow is determined by the rate of rotation of the analyzer and the angle between each cut in the tape.

Because the cutting of tape is such a delicate operation, it is wise to use some type of illuminated magnifying device. The use of a commercial drafting machine or an expandable triangle will make the process of cutting tape much easier. It should be remembered that in using this type of projection system, only about 37 per cent of the light is transmitted and a projector with a 1000 watt light source should be used.

Commercially-made materials. The Technifax Corporation of Holyoke, Massachusetts, produces prefabricated motion material which is sold by the name "Technamation motion-material". It is constructed of cellophane and polarizing material and is adhesive backed. The filter is coated with clear adhesive and the strips of cellophane, cut to predetermined angles and widths, are attached in parallel, shingle-like columns. The strips are cut at five degree angles (0, 5, 10 degrees, etc.) and come in one-eighth and one-sixteenth inch widths. The series of angles is duplicated over-and-over again for the entire length of the column. When using Technamation materials, a stage filter

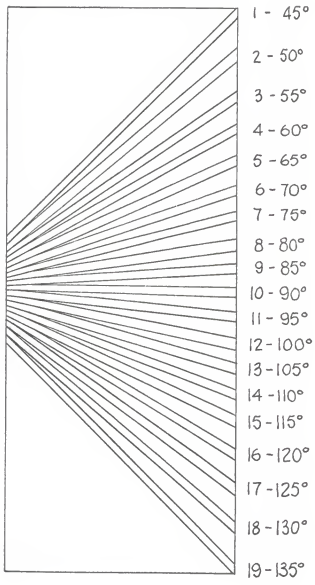

FIGURE 6

CUTTING METHOD FOR CREATING FLOW (FROM TAYLOR, A MANUAL OF VISUAL PRESENTATION IN EDUCATION AND TRAINING)

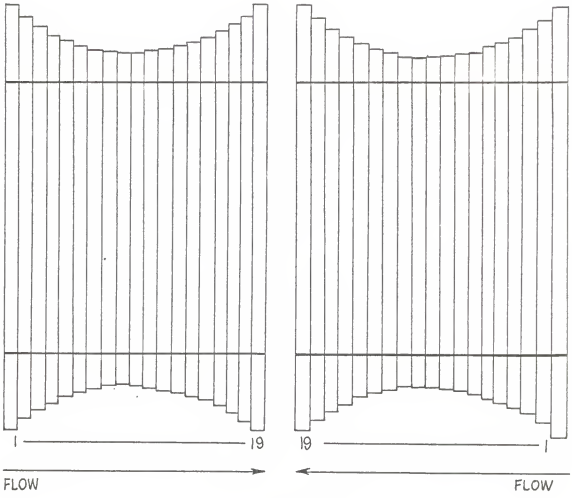

FIGURE 7

METHOD OF SIMULATING VERTICAL LINEAR MOTION (FROM TAYLOR, A MANUAL IN VISUAL PRESENTATION IN EDUCATION AND TRAINING)

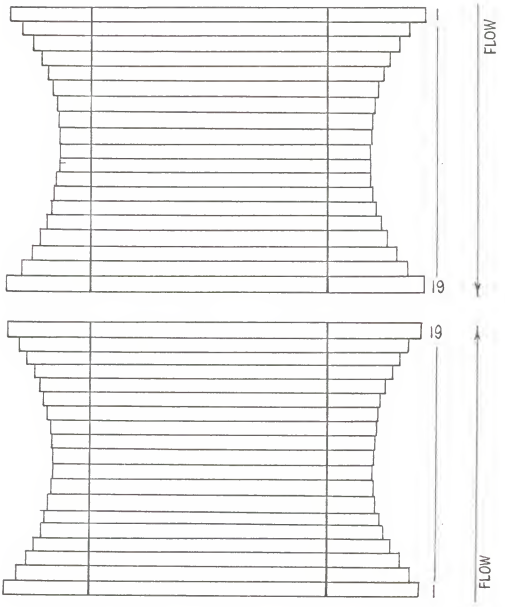

FIGURE 8

METHOD OF SIMULATING HORIZONTAL LINEAR MOTION (FROM TAYLOR, A MANUAL IN VISUAL PRESENTATION IN EDUCATION AND TRAINING)

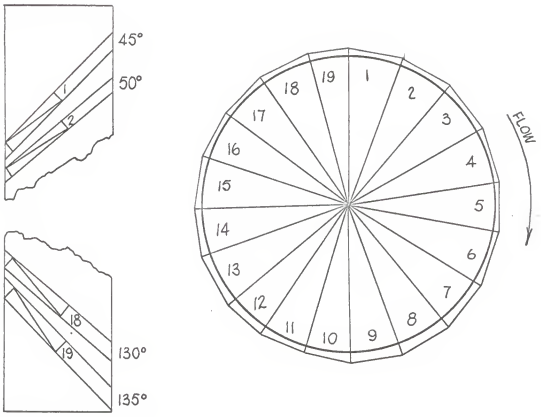

FIGURE 9

METHODS OF CUTTING AND APPLICATION TO ACHIEVE CIRCULAR MOTION
(FROM TAYLOR, A MANUAL IN VISUAL PRESENTATION
IN EDUCATION AND TRAINING)

is not required.

The material serves essentially the same purposes as the handmade method previously described and can simulate the flow of liquids, rotation of gears, the action of pumps, rotation of cylinders, chemical reactions, and electromagnetic radiation.

Technamation material is relatively opaque and should be applied to the transparency over a light box or other illuminated working surface. To use the material, a strip is placed over the area of desired action, the outline of the area scribed on it, and the scribed area cut out with a knife or pair of scissors. The protective backing is peeled away and the pressure sensitive adhesive exposed, and the material is positioned on the front of the projectual. If when trying out the projectual under the rotating analyzer, it is found that the material was applied upside-down and the motion occurs in the wrong direction, this problem may be easily remedied. The strip may be removed and inverted, the rotation of the analyzer may be reversed, or the motion material may be covered with cellophane. The cellophane acts as a reversing sheet by refracting or bending the rays in the opposite direction. Technamation material is more expensive than cellophane and filter material because it is all handmade.[1]

---

[1] Ibid., p. 6.

Polaroid Vectograph film. Out of World War II came the Vectograph film and chemicals used for the production of three-dimensional photographs for aerial reconnaisance. A Vectograph print is a continuous-tone or line art pictorial representation in which the image is produced optically through the medium of polarized light. But, instead of forming an image by means of a pigment, a dye, or particles of silver or other metal, the image is made up of polarized molecules on the surface of the film. Unprocessed Vectograph film is optically clear.[1]

Standard Vectograph film is coated on both surfaces; it has two receiving surfaces. Each surface is composed of molecules which are oriented basically parallel to one another, and diagonally to the edge of the film at an angle of 45 degrees. (See Figure 10).

A single image Vectograph print, when viewed in ordinary room light, looks much like an underdeveloped positive transparency such as would be produced on the Thermo-fax copier. A faint image can be seen because room light contains a small amount of polarized light. When the Vectograph print is viewed using the polarizing analyzer, the image may be made to completely disappear at certain locations on the polarizing disc. As the analyzer is slowly

---

[1] "Polarizing the Projectual," Audio-visual Instruction, 7:245, April, 1962.

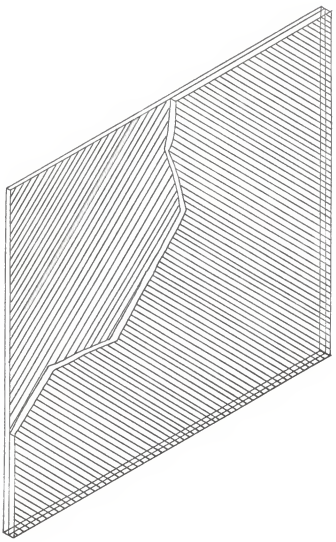

FIGURE 10

THE CONSTRUCTION OF VECTOGRAPH FILM
(FROM POLARIZING THE PROJECTUAL,
TECHNIFAX CORPORATION)

rotated, the Vectograph image first appears faintly, then the density and contrast increases as the angular displacement of the polarized light increases.[1] Best projection effects are achieved when the analyzer is perpendicular to the position where no image was shown.

The use of Vectograph film makes possible the superimposition of two images on a single sheet of film, one on each side. If an image is placed on each side of the film, both images will be seen in ordinary unpolarized light. However, under polarized light, each image may be projected independently of the other. An additional advantage of Vectograph film is that very little projected light is cancelled, and the projected image may be used with a positive or clear background. When an image is printed on only one side of a Vectograph film, it may be superimposed over a Diazochrome image. The Diazochrome image may then be projected by itself, or the analyzer may be rotated and the Vectograph image will blend in to complete the picture. (See Figure 11). If a different image is printed on each side of the Vectograph film, each may be blended into the Diazochrome separately through the rotation of the analyzer. Although not required, the use of a stage filter results in the best viewing when using Vectograph film.

---

[1] Ibid.

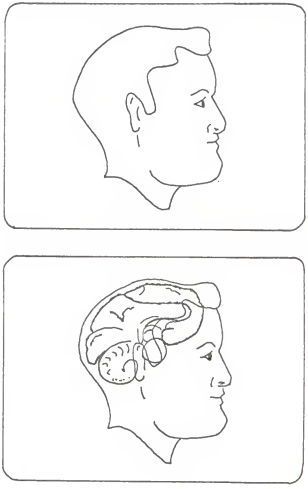

FIGURE 11

EFFECT OF SUPERIMPOSITION OF VECTOGRAPH AND DIAZOCHROME FILMS (FROM POLARIZING THE PROJECTUAL, TECHNIFAX CORPORATION)

There are several definite steps in preparing the Vectograph print. The materials needed are a photographic matrix, Vectograph ink, a "pre-wet" solution, stabilizing solution, and a sheet of Vectograph film. A matrix is a special ink-coated film yielding an etched image from which a contact print can be made and is obtainable from most photographic supply houses. Vectograph ink is an iodine dye, combined with sodium chloride and sulphuric acid to stabilize the dye. The "pre-wet" solution conditions and cleans Vectograph film for the image transfer.

First, a photographic negative of the image to be projected is printed on the matrix. Then the matrix is placed in the Vectograph printing ink. Simultaneously, the Vectograph film is placed in the "pre-wet" solution. The matrix and the film are allowed to stand in their respective solutions for about three minutes and then are removed. The Vectograph film is placed on a smooth flat surface, the matrix is aligned to it along one edge, and the two are squeegeed together. Care must be taken to be sure the image side of the matrix comes into contact with the film. After leaving the matrix and film together for thirty seconds, the matrix is peeled away and the film immediately placed in the stabilizing solution. The stabilizer permanently sets the image and keeps it from fading. The film is left in the stabilizer for forty-five seconds, removed, blotted between two paper towels, and hung up to dry. When dried,

it can be put away for future use unless a second print is desired immediately. Then the matrix is not rinsed and the printing process is repeated.[1]

If both sides of the Vectograph film are to have an image, two matrices are required. The matrices are prepared as above and the Vectograph film is sandwiched between the image faces. In this way, a different image is printed on each side of the film. Perfect contact must be achieved. Rubber rollers (wringers) are used to squeeze the matrices and film together. The sandwich is allowed to stand intact for one minute and then the film is removed from between the matrices. The film is placed in the stabilizer for one minute, removed, and hung up to dry.

Vectograph transparencies may also be produced by writing or drawing directly on the film. A No. 0 or No. 1 Acetograph Pen filled with Vectograph ink should be used. Stabilizer is then applied with cotton dabs and the film is blotted dry with tissue paper. Different drawings can be made in this manner on each side of the Vectograph film.

MOTION EMPLOYED IN THE CLASSROOM

This segment of the report will deal with usable ways of implementing classroom instruction using the methods

---

[1] "Polarized Projectuals" (Holyoke, Massachusetts: Technifax Corporation, 1961), p. 8.

described previously. Each content area will be dealt with separately.

Art has been discussed to some extent in relation to the study of composition through slides with mobile elements. It is possible that polarized light could also be employed in the instruction of composition. Certainly polarized light would be extremely useful in the teaching of color theory and color mixing. Motion media lends itself well to the instruction of any mechanical process involving motion such as how to use a lettering pen or how to operate a printing press.

Many avenues or exploitation of polarized light are available in the field of business education. The use of Technamation could make learning of the correct fingering of a typewriter keyboard more effective. A set of visuals dealing with the steps which a personal check goes through, could be effective. The correct formation of shorthand symbols could also be the subject of a polarized presentation.

The teaching of foreign languages could also be affected by the use of motion. A transparency dealing with the operation of individual tape recorders in a language laboratory could lead to increased learning. Foreign language also exhibits many possibilities for the teaching or drill of words through relating the visual image to the written or spoken symbol.

There are many processes which must be taught in industrial education. The operation of many of the complicated machines with which the student must deal, could be taught using motion visuals. The teaching of shop safety is an area critically in need of student stimulation and motion in visuals could help to meet this need.

Home economics could be well served by motion in still pictures. There are many operations or skills needed to be learned that could be served by this form of media. For example, the processes of operating a sewing machine, cutting out a dress, or devising an original pattern are possible areas for exploration. An interesting visual could be created illustrating the internal operation of a steam iron.

A motion projectual dealing with sentence structure could be employed in language arts. Comparisons of style and the development of reading skills are two other areas of possible implementation. In secondary school, creative visuals dealing with the use of the library or writing a business letter could be developed. Relating words to objects could be done at the elementary level.

Visual presentations have long been a part of mathematics. Many approaches to problem solving in the elementary school could be devised through motion in still pictures. Learning to make change and to tell time are

other segments of learning that could be expanded by motion visuals. An obvious use for motion visuals in the secondary schools would be in geometry, particularly in theorem proofs.

The field of music might also make use of motion in still pictures. How valuable a set of transparencies showing band formations could be! Fingering charts for all types of instruments from the piano to the piccolo could have added efficiency through the use of motion.

Science probably contains more opportunities for the development of polarized light use in teaching than any other single content area. A list of possible uses in the elementary school science program would nearly be endless. For example, the explanation of the growth of a tree, the orbits of planets and man-made satellites, and the metamorphosis of a caterpillar into a butterfly could become extremely meaningful to students through the use of polarized light. In secondary school, presentations on the circulatory systems of man and animals, internal organs, the care of teeth, and cell division are possible, just to name a few. In physical sciences, chemical reactions, the internal workings of machines, gear ratios, and many others could be effectively treated with visual motion.

Skills and form in many sports such as swimming, tumbling, bowling, and wrestling could be taught more

effectively by motion in projectuals in the physical education class. Instruction in plays in football and basketball could be made easier by employing motion.

Simple motion and polarized light also have their place in social studies. Study of boundary changes and geographical relocation could have added zest through motion visuals in geography, current affairs, and history. Moving graphs could be used in civics and economics. Battle plans and explorer's routes could be made more meaningful in history and geography through motion media.

The above are but a few suggestions of possible use. The classroom teacher will be able to think of many more. Implementation of polarized light and other methods of achieving motion will come as a result of teacher experimentation. It is up to him to use all of the tools which he may have as resources.

SUMMARY

The use of audio-visual devices has become prevalent in the school of today. However, little research in the use of motion in visual presentations has been made.

Several techniques of creating motion were listed for use by the classroom teacher. Motion in bulletin boards, it was stated, could be achieved by employing photographs with inherent motion, diagonal elements, or bright vivid colors.

Multi-exposures and "blurring" in photography were effects also listed to add motion to the presentation.

Motion in graphics was found to be achieved by introducing an object into a picture several times to represent stages, by exhibiting several different views or planes simultaneously, or by allowing the viewer's eye to visually draw in missing elements.

The teaching of composition in the art class was found to be enhanced by creating motion in slides. The slides could either be constructed out of materials whose melting point was equivalent to the heat given off by the projector, or with lightweight materials which could be caused to move by the air currents generated by the projector fan.

The most promising field of methods for producing motion was found to be polarized light coupled with the overhead projector. A polarized system was found to consist of two polarized filters which contain parallel stress lines or lines of crystals. The bottom filter, called the polarizer, and the top filter, the analyzer, must always have the projectual located between them. Then, as the analyzer is rotated, either by machine or manually, the subtraction of variable wave lengths of light causes the visual effects. Cellophane is used to complete the interference necessary for polarization and is affixed to the projectual. The cellophane is placed on the projectual at either an angle of

15 degrees or 45 degrees relative to the edge of the projectual. By placing several layers of cellophane on the projectual, color effects can be added to the presentation.

Simple motion techniques are easily handled by the teacher. By cutting cellophane sheets or cellulose tape at various angles, the effects of blinking lights, boiling substances, flames, liquids flowing through pipes, or turning wheels may be produced. Commercial materials are available for teacher use that accomplish the same results.

The use of Vectograph film allows the teacher to superimpose two images and project them together or independently of each other. Vectograph film may also be used with Diazochrome films to add color to the transparency. The use of Vectograph film is based on its unique construction, it has two receiving surfaces whose stress lines are perpendicular to each other.

The use of motion in various subject areas was discussed and it was pointed out that there are needs in all that may be served by the methods treated. Several examples were given for each of the fields of art, business education, foreign languages, industrial education, home economics, English, mathematics, music, science, physical education, and social studies.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Brown, James, Richard Lewis, and Fred Harcleroad. A-V Instruction: Materials and Methods. New York: McGraw-Hill Book Company, 1964.

Cross, A. J. Foy and Irene F. Cypher. Audio-Visual Education. New York: Thomas Y. Crowell Company, 1961.

Dale, Edgar. Audio-Visual Methods in Teaching. New York: The Dryden Press, 1954.

Moholy-Nagy, Laszlo. Vision in Motion. Chicago: Paul Theobald Company, 1947.

Taylor, E. A. A Manual of Visual Presentation in Education and Training. New York: Pergammon Press Limited, 1966.

B. PUBLICATIONS OF ORGANIZATIONS

Diazochrome Projectuals for Visual Communication. Holyoke, Massachusetts: The Technifax Corporation, 1964.

Polarized Projectuals. Holyoke, Massachusetts: The Technifax Corporation, 1961.

C. PERIODICALS

Henle, Fritz. "Camera...Action!," Popular Photography, 53:28, September, 1963.

"Polarizing the Projectual," Audio-Visual Instruction, 7:242-6, April, 1962.

Wildi, Ernest. "Must Dimension: Motion," Popular Photography, 54:11-13, June, 1964.

D. FILMS

Line #5, a film produced by Henk-Newenhouse, Incorporated, Northbrook, Illinois, 1965.

METHODS OF ACHIEVING MOTION IN STILL PICTURES FOR USE BY CLASSROOM TEACHERS

by

FREDRICK HANS JURGEMEYER
B. S., Kansas State University, 1965

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

College of Education

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1967

In order to be consistent with the student's world, motion needs to be employed into educational presentations. It was the purpose of this study to research various methods of increasing effectiveness of still media by incorporating motion into the presentation. Special emphasis was placed on researching methods which could be easily employed by the classroom teacher.

Motion is necessary in presentations because it may be used with students with reading deficiencies, it can help to overcome physical limitations, it is used easily with color, it can be used for enlargement, it conveys abstract ideas better at times, and is an attention getting device.

Photography plays an important part in bulletin board construction. Motion may be achieved in photography through the use of inherent motion, oblique lines, vivid colors, superimposition or blurring. Likewise, motion in graphics can be used in bulletin boards and is achieved through multi-scene pictures, multi-plane pictures, and inferred movements.

Motion may be achieved in slides by using the heat or wind currents issued by the projector as an energy source.

The use of polarized light can create motion through its many techniques. Polarized light is the process of bending light rays through two polarizing filters which contain stress lines and are called the polarizer and the analyzer. The projectile must always be located between these two.

Cellophane is used on the transparency to create the effects desired. Differing layers and angles of cellophane determine the color variations. Cellophane cut at different angles can give effects of blinking lights, boiling liquid, flames, smoke, liquids flowing, and turning wheels. These effects may be created entirely by hand by the teacher, or commercially made materials are available.

Vectograph film can be used to create motion due to the fact that it has two receiving surfaces or faces upon which an image may be placed. The two images may be shown independently of each other and may be used in conjunction with Diazochrome films to add color.

Polarized light lends itself to use with all content areas.